DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Housing—Federal Housing Commissioner

TO: DIRECTORS, HOUSING DIVISION
DIRECTORS, MULTIFAMILY DIVISION
DIRECTORS, SINGLE FAMILY DIVISION

STRUCTURAL ENGINEERING BULLETIN NO. 1104 Rev. 2
(Supersedes issue dated June 29, 1993)

ISSUE DATE: October 7, 1996

REVIEW DATE: October 7,1999

SUBJECT: 1. **Item Description** Shop Fabricated Foam Core Sandwich Panels (AFM -R- Control Panels)

2. **Name and Address of Manufacturer** AFM Corporation
Box 246
Excelsior, MN 55331

This Structural Engineering Bulletin (SEB) should be filed with other SEBs and related bulletins on materials or products as required by prescribed procedures.

The technical description, requirements and limitations expressed herein do not constitute an endorsement or approval by the Department of Housing and Urban Development (HUD) of the subject matter, and any statement or representation, however made, indicating approval or endorsement by HUD is unauthorized and false, and will be considered a violation of the United States Criminal Code, 18 U.S.C. 709.

NOTICE: THIS BULLETIN APPLIES TO DWELLING UNITS BUILT UNDER HUD HOUSING PROGRAMS. NON-HUD INSURED UNITS MAY OR MAY NOT BE IN CONFORMITY WITH THE REQUIREMENTS OF THE HUD MINIMUM PROPERTY STANDARDS.

Any reproduction of this Bulletin must be in its entirety and any use of all or any part of this Bulletin in sales promotion or advertising is prohibited.

1. General:

This Bulletin sets forth specific requirements under the Technical Suitability of Products Program for determining the eligibility of housing to be constructed under HUD mortgage insurance or other HUD housing programs.

2. Scope:

This Bulletin applies only to the structural features of this method of construction. Final determination of eligibility is made by the appropriate HUD Field Office. Other factors considered by the Field Office will be valuation, location, architectural planning and appeal, mechanical equipment, thermal characteristics, and market acceptance. Consideration is also necessary to determine whether a specific property will qualify under the specific HUD program when constructed according to the method outlined in this Bulletin and where the structure is to be located.

In geographical areas subject to hurricanes, earthquakes, or other severe conditions affecting dwelling structures, the HUD Field Office shall require additional safeguards in proposed designs, when necessary.

3. Minimum Property Standards (MPS):

Compliance with HUD MPS will be determined by the HUD Field Office on the same basis as submissions involving conventional construction, except for the special features described in this Bulletin.

4. Inspection:

Field compliance inspections covering conventional items of construction and any special features covered in this Bulletin shall be made in accordance with prescribed procedures.

The appropriate HUD Field Office shall furnish a copy of a HUD field inspection report to Headquarters, Manufactured Housing and Standards Division, Office of Consumer and Regulatory Affairs, when there is:

a. Evidence of noncompliance with portions of the system of construction described in this Bulletin.

b. Faulty shop fabricated, including significant surface defects.

c. Damage to shop fabricated items or materials due to improper transportation, storage, handling, or assembly.

d. Unsatisfactory field workmanship or performance of the product or system.

e. Any significant degradation or deterioration of the product or evidence of lack of durability or performance.

Periodic plant inspections will be made by HUD Field Office or State Agency personnel in accordance with their prescribed procedures. Factory inspection reports shall be submitted to HUD Headquarters, upon request.

5. Certification:

The manufacturer named in this Bulletin shall furnish the builder with a written certification stating that the product has been manufactured in compliance with the HUD Minimum Property Standards (MPS), except as modified by this Bulletin. The builder shall endorse the certification with a statement that the product has been erected in compliance with HUD MPS, except as modified by this Bulletin, and that the manufacturer's certification does not relieve the builder, in any way, of the responsibility under the terms of the Builder's Warranty required by the National Housing Act, or under any provisions applicable to any other housing program. This certification shall be furnished to the HUD Field Office upon completion of the property.

OUTLINE DESCRIPTION, CATEGORY II CONSTRUCTION:

GENERAL:

Shop fabricated foam core sandwich roof, exterior wall, and floor panels for one-, two- and three-story dwellings are furnished in this methods of construction. Panels consist of waferboard or oriented strand board (OSB) skins and polystyrene foam cores. Panels are transported to the building site where they are connected together.

Conventional construction may include various types of interior and exterior finish materials. All materials and methods of installation shall be in accordance with HUD Minimum Property Standards, Use of Materials Bulletin (UM), and Materials Releases (MR), except as may be specially noted herein. Plumbing, heating and electrical systems are shop installed and field connected.

This Bulletin is based on a structural review of AFM R-Control panels for one-, two- and three-story dwellings. Foundation design and nonstructural items (such as architectural, plumbing, heating and electrical features) are not covered by this Bulletin.

SPECIFICATIONS:

Form HUD-92005, "Description of Materials" specifying only the structurally related items (Nos. 1 to 12, 14, 26 and 27), as originally submitted for technical suitability determination, describes the materials that shall be used in construction of housing units under this system of construction. Form HUD-92005, furnished with each application for use under HUD housing programs, shall include as a minimum the same structural materials.

DRAWINGS:

The following drawings by AFM Corporation shall be considered an integral part of this Bulletin:

Drawing No.	Date	Description
AF-101	6/10/88	Plate Connections
AF-102	6/10/88	Spline Connection
AF-103	6/10/88	Corner Connection
AF-104	6/10/88	Slab Foundation Framing
AF-104a	6/10/88	Slab Foundation Framing
AF-105	6/10/88	Foundation Framing
AF-105a	6/10/88	Foundation Framing
AF-106	6/10/88	Foundation Framing-Trusses
AF-107	6/10/88	Slab to Elevated Floor
AF-108	6/10/88	Flush Frames-Floor & Roof Deck
AF-109	6/10/88	Floor to Floor Framing
AF-110	6/10/88	Stair Framing
AF-111	6/10/88	Wall to Wall Connection
AF-112	6/10/88	Standard Framing to R-Control
AF-113	6/10/88	Typical Door & Window Openings
AF-114	6/10/88	Header Span Recommendations
AF-115	6/10/88	Window Opening
AF-116	6/10/88	Window Jamb Details
AF-117	6/10/88	Door Jamb Details
AF-118	6/10/88	Roof Beam Framing
AF-119	6/10/88	Beam Pocket
AF-120	6/10/88	Roof Panels/Reinforcing Angles and Straps
AF-121	6/10/88	Attached Roof
AF-122	6/10/88	Facias
AF-123	6/10/88	Rake Overhang
AF-124	6/10/88	Truss Bearing Wall
AF-125	6/10/88	Ceiling Panel
AF-126	6/10/88	Roof Opening
AF-127	6/10/88	Cold Roof
AF-128	6/10/88	Electrical Chase-Beams
AF-129	6/10/88	Electrical Chase-Panel
AF-129a	6/10/88	Electrical Box
AF-130	6/10/88	Cabinet Attachment
AF-131	6/10/88	Electrical Chase-Base
AF-132	6/10/88	Plumbing Chase
AF-HUD	6/10/88	Solid Spline Connection (Wall)

The Builder shall submit construction drawings to the HUD Field Office with each application under HUD housing programs, which shall include the same or similar structural features shown on the drawings listed above. A professional engineer licensed in the appropriate state shall prepare plans and construction details for specific projects and geographical conditions. Copies of the listed drawings shall also be furnished to the HUD Field Office by the Builder upon request.

SPECIAL CONSTRUCTION FEATURES:

General: The AFM R-Control foam core sandwich buildings panels vary in size from 4′ to 24′ in length, and from 8′ to 10′ in height (10′ high panels are limited to 8′ widths). Panel core thicknesses range from 3 1/2" through 11 1/2". The facing thickness of the wood fiber layer is 3/8" through 3/4" depending on the load requirements. Panels can be used individually or may be connected to form larger sections and assemblies.

Facings, Foam Core and Adhesive: Panels consist of two layers of waferboard facings. The waferboard facings must bear the stamp of the American Plywood Association. Waferboard exhibiting these markings must also meet the minimum acceptance limits (MOE-450,000 psi and MOR-2,500 psi) as outlined in the AFM Quality Control Program. The expanded polystyrene (EPS) core material is nominal 1.0 pcf density, Type I, flame modified polystyrene insulation board in accordance with ASTM C-578-85 and AFM certified. Skins shall be bonded to the foam cores with Ashland Chemical Company Isoset No. WD3-A320 and 322 emulsion polymer/isocyanate, or Morad 434 adhesive.

Field Assembly: Wall panels for one-story dwellings and one-story dwellings with loft, roof panels spanning up to 4′, and the AFM R-Control panels are connected to each other at the panel edges by using thermal break wood splines. The splines are field coated with an EPS, wood-to-wood adhesively bonded and mechanically fastened using 8d box nails at 6" o.c. or using other fastening methods substantiated by calculations to provide equivalent or higher shear strength properties.

Wall panels for two- and three-story dwellings, roof panels spanning over 4′, and floor panels shall be connected to each other with solid wood splines in accordance with the referenced drawings.

The top and bottom plates of the panel are dimension lumber sized to match the core thickness and are installed using adhesive and 8d box nails at 6" o.c. or approved equal. An EPS latex caulk is applied along the base plate prior to the panel placement.

Openings: Openings in the wall shall be limited to 48" in width, and the allowable load shall not exceed the value specified in Chart 1 or 2, unless designed for a specific condition by a registered professional engineer, using conventional framing method.

DESIGN AND CONSTRUCTION REQUIREMENTS:

Design Loads (Allowable Superimposed Loads): The method of construction described in this Bulletin is based on the following allowable superimposed load tables:

LOAD DESIGN CHART NO. 1
(Wall and Roof Panels)

AFM R-CONTROL® PANELS													
			EPS CORE THICKNESS										
			3½" CORE				5½" CORE				7½" CORE			
			WAFERBOARD THICKNESS				WAFERBOARD THICKNESS				WAFERBOARD THICKNESS			
ROOF OR TRANSVERSE LOAD (psf)	PANEL SPAN	DEFLECTION	⅜"	½"	⅝"	¾"	⅜"	½"	⅝"	¾"	⅜"	½"	⅝"	¾"
	8'-0"	L/180	—	—	—	—	—	—	—	—	—	—	—	—
		L/240	39	41	43	44	—	—	—	—	—	—	—	—
		L/360	25	26	27	26	40	41	42	43	55	59	60	60
		(1)	L/213	L/219	L/229	L/235	L/253	L/259	L/267	L/271	L/280	L/291	L/291	L/299
		(2)	46	46	46	46	61	61	61	61	76	76	76	76
	10'-0"	L/180	38	39	40	42	—	—	—	—	—	—	—	—
		L/240	29	30	31	32	44	44	46	46	—	—	—	—
		L/360	19	20	21	21	30	29	30	31	56	55	56	57
		(1)	L/150	L/154	L/158	L/162	L/182	L/186	L/189	L/194	L/300	L/300	L/300	L/308
		(2)	46	46	46	46	57	57	57	57	68	68	68	68

(1) Deflection at failure load divided by a factor of safety to three (3).

(2) Failure load divided by a factor of safety of three (3) (Transverse load).

LOAD DESIGN CHART NO. 2
(Wall Panels)

AFM R-CONTROL® PANELS													
	PANEL HEIGHT OR SPAN	EPS CORE THICKNESS											
		3½" CORE				5½" CORE				7½" CORE			
		WAFERBOARD THICKNESS				WAFERBOARD THICKNESS				WAFERBOARD THICKNESS			
		3/8"	½"	5/8"	¾"	3/8"	½"	5/8"	¾"	3/8"	½"	5/8"	¾"
AXIAL (1) LOAD (p.l.f.)	8'-"0"	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
	10'-0"	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2425	2200
COMBINED (1) AXIAL AND BENDING LOAD (p.s.f.)	8'-0"	45	46	46	46	59	60	61	61	72	74	76	78
	10'-0"	33	34	35	36	38	39	41	42	43	44	46	47
RACKING SHEAR		185 p.l.f.				185 p.l.f.				185 p.l.f.			
48" HEADER (p.l.f.)		504 p.l.f.				504 p.l.f.				504 p.l.f.			

(1) Maximum allowable axial load is limited to the loads tabulated for axial load condition alone.

LOAD DESIGN CHART NO. 3*
(Roof and Floor Panels)

Maximum Allowable Span in Feet					
	Roof Panels L/360				Floor Panels L/360
		20 psf	30 psf	40 psf	LL = 40 psf
EPS Core Thickness	7 1/2"	16'	14'	12'	NA
	9 1/2"	20'	17'	16'	12' (1)
	11 1/2"	24'	20'	18'	14' (1)

* Allowable spans for flush framing designs are calculated using dimension 2x side members on all panel edges. Panels are framed with double 2x's at 4'-0" o.c. and single 2x's at the panel edges as end blocking. See Drawing AF-108 in the AFM R-Control Construction Detail Booklet for proper layout of flush-framed roof and floor decks.

Top skin thickness for floor panels shall be 5/8" minimum to provide adequate resistance to impact and point loading.

Top skin thickness for roof panels shall be 7/16" minimum to provide adequate thickness for nail holding.

Bottom skin thickness for floor and roof panels will vary.

(1) Design load limitations: Foam core floor panels under significant long-term sustained loads may be subject to creep-deflection or creep-rupture. Panel spans noted (1) are less than short-term load test. These allowable spans may be increased if verified by appropriate tests including creep-deflection and creep-rupture and engineering analysis.

Fire Protection and Interior Finish: The polystyrene foam core shall have a flame spread rating of not more than 75, and a smoke development rating of not more than 450 when tested in accordance with ASTM E-84. All interior ceilings and wall surfaces are covered with 1/2" thick gypsum wallboard or equivalent material with a 15-minute finish (fire) rating. Floor finish shall be a minimum of 5/8" (5/16" x 5/16") blandex or plywood.

Framing of Loadbearing Walls: Wood-to-wood connections shall be provided between bearing walls and roof/ceiling or floor construction. Floor covering, including carpeting and vinyl tile, shall not be continued under loadbearing walls.

Roof Construction: Trussed rafters shall be designed and constructed in accordance with Truss Plate Institute (TPI-85), "Design Specification for Metal Plate Connected Wood Trusses", and the appropriate HUD Truss Connector Bulletin.

MANUFACTURING PLANTS:

Shop fabricated foam core sandwich roof, wall and floor panels covered under this Bulletin will be produced in the following plants:

ADVANCE FOAM PLASTICS, INC.
5250 North Sherman Street
Denver, CO 80216
(301) 297-3844 or 800-525-8697

ALL AMERICAN FOAM PRODUCTS
301 Eubank S.E.
Albuquerque, NM 87123
(505) 299-7653

ALLIED FOAM PRODUCTS, INC.
1604 Athens Highway
Gainsville, GA 30503
(404) 536-7900 or 800-533-2613

BIG SKY INSULATIONS, INC.
15 Arden Drive
Belgrade, MT 59714
(406) 388-4146 800-766-3626

BRANCH RIVER FOAM PLASTICS, INC.
15 Thurber Boulevard
Smithfield, RI 02917
(401) 232-0270

CONTOUR PRODUCTS, INC.
1418 Cow Palace Road
Newton, KS 67114
(316) 283-1100

INSULATED BUILDING SYSTEMS, INC.
326 McGee Road
Winchester, Va 22603
(703) 662-0882

PREMEIR BUILDING SYSTEMS
007 Sunburst Lane
Mead, NE 60841
(402) 624-6611

PACEMAKER PLASTICS CO., INC.
126 New Pace Road
Newcomerstown, OH 43832
(614) 498-4181 or 800-446-2188

POLY-FORM INC.
116 Pine Street South
Lester Prairie, MN 55354
(612) 395-2551

THERMAL FOAMS, INC.
2101 Kenmore Avenue
Buffalo, NY 14207
(716) 874-6474 or 800-333-6267

PREMIER BUILDING SYSTEMS
Division of Western Insulfoam
8939 South 190th Street
Kent, WA 98031
(206) 251-9277

WISCONSIN EPS, INC.
90 Trowbridge Drive
Fond du Lac, WI 54936
(414) 923-4146 or 800-236-5377

TEAM INDUSTRIES, INC.
4580 Airwest Drive S.E.
Kentwood, MI 49512
(616) 698-2001

The following appropriate HUD Offices will inspect respective plants in accordance with prescribed procedures:

Denver, CO; Albuquerque, NM; Atlanta, GA; Helena, MT; Providence, RI; Kansas City, MO; Richmond, VA; Omaha, NE; Cleveland, OH; Minneapolis-St. Paul, MN; Buffalo, NY; Seattle, WA; Milwaukee, WI; and Grand Rapids, MI.

QUALITY CONTROL:

The HUD Field Office in whose jurisdiction the manufacturing plant is located shall review and approve plant fabrication procedures and quality control program, and shall report to HUD Headquarters in accordance with outstanding instructions. The quality control program shall include field erection and supervision by AFM Corporation of its representative.

RECORD OF PROPERTIES:

The manufacturer shall provide a list of the first ten properties in which the component or system described in this Bulletin is used. The list shall include the complete address, or description of location, and approximate date of installation or erection. Failure of the manufacturer to provide HUD with the above information may result in cancellation of this Bulletin.

NOTICE OF CHANGES:

The manufacturer shall inform HUD in advance of changes in production facilities, transportation, field erection procedures, design, or of materials used in this product. Further, the manufacturer must inform HUD of any revision to corporate structure, change of address or change in name or affiliation of the prime manufacturer. Failure of the manufacturer to notify HUD of any of the above changes may result in cancellation of this Bulletin.

EVALUATION:

This SEB shall be valid for a period of three years from the date of initial issuance or most recent renewal or revision, whichever is later. The holder of this SEB shall apply for a renewal or revision 90 days prior to the Review Date printed on this SEB. Submittals for renewal or revision shall be sent to HUD Headquarters. Appropriate User Fees shall be sent to:

U. S. Department of Housing and Urban Development
Technical Suitability of Products Fees
P. O. Box 954199
St. Louis, MO 63195-4199

The holder of this SEB may apply for revision at any time prior to the Review Date. Minor revisions may be in the form of a supplement.

If the Department determines that a proposed renewal or supplement constitutes a revision, the appropriate User Fee for a revision will need to be submitted in accordance with Code of Federal Regulations 24 CFR 200.934, "User Fee System for the Technical Suitability of Products Program", and current User Fee Schedule.

CANCELLATION:

Failure to apply for a renewal or revision shall constitute a basis for cancellation of the SEB. HUD will notify the manufacturer that the SEB may be canceled when:

1. conditions under which the document was issued have changed so as to affect production of, or to compromise the integrity of the accepted material, product, or system,

2. the manufacturer has changed its organizational form without notifying HUD, or

3. the manufacturer has not complied with responsibilities it assumed as a condition of HUD's acceptance.

However, before cancellation, HUD will give the manufacturer a written notice of the specific reasons for cancellation, and the opportunity to present views on why the SEB should not be canceled. No refund of fees will be made on a canceled document.

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This Structural Engineering Bulletin is issued solely for the captioned firm and is not transferable to any person or successor entity.
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